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Umberto Albarella

Size, power, wool and veal: zooarchaeological evidence for late medieval innovations

Introduction

The late Middle Ages was a period of changes in England. The decline of the population and the desertion of vast areas of the countryside caused by the Black Death of the 14th century brought about a slow transformation of society and its economy. Farming and pastoral activities were much affected and gradual modifications in the cultivation of the land and the use of animals eventually led to that set of changes in agrarian practices usually called the “agricultural revolution” (*sensu* Kerridge 1967). These phenomena have for a long time been studied by social and agricultural historians but archaeology has also made a contribution. “The archaeologists have accumulated a mass of information, almost embarrassing in its sheer quantity, for the physical conditions of the past...” (Dyer 1989a, 3), but unfortunately this large bank of data is not easily accessible, hidden in large numbers of “site reports” and even more often never published. Data concerning agricultural life are mainly discussed in sections or appendices on human bones, animal bones and plant remains, which may be difficult to read for the non-specialist, and are often poorly integrated in the general interpretation of a site, let alone a wider geographic area. Fortunately a few syntheses have been made (see for instance Grant 1988 and Greig 1988), but there is still much to be done.

This paper aims to be a contribution in that direction. During the last ten years new archaeological evidence about changes in the use of animals in late medieval and early modern times has come to light. This evidence seems to confirm and complement what historians have been saying and it is, in this respect, most important. We have now direct archaeological indication that, probably since the 15th century and maybe earlier, the emphasis in the kind of use of the main domestic animals was in a process of transformation. The aim of this paper is to review our evidence for these innovations and to see how they contributed towards the creation of a new system of animal exploitation. Here I shall rely upon the infor-

mation provided by a number of zooarchaeological studies carried out in different parts of England, but also on original work on the animal bones from three important medieval and post-medieval sites, which I have studied – with colleagues – during the last four years. The three main sites discussed here are conveniently situated in different parts of the country, and in particular in the west country (Launceston Castle: Albarella & Davis 1996), in central England (West Cotton: Albarella & Davis 1994 and forthcoming) and in East Anglia (Norwich, Castle Mall: Albarella *et al.* forthcoming) (Fig. 1).

Any overview runs the risk of oversimplifying the evidence. We are dealing with complex phenomena, which are subject to much chronological and regional variation, and are influenced by a large number of variables related to differences in society, the environment, the cultural context and so on. In my attempt at identifying general trends some of this variability and complexity will be left unmentioned. This does not mean that I am not aware of the fact that, for instance, what happened in the south of the country cannot be entirely applied to the north or that changes in marginal areas did not occur at the same pace as in more central regions. However, I also believe that only by trying to pose general questions, and when possible providing answers to them, can we reconstruct the way medieval people brought about the creation of modern farming.

Size increase

The most remarkable evidence of a change in the type of animals — and consequently in their use — between medieval and early modern times comes from bone measurements. Cattle, sheep and to some extent pig, domestic fowl and possibly horse all increased in size, and recent archaeological evidence suggests that the beginning of this trend is to be found already in the 16th century, and possibly earlier. This important phenomenon is reviewed elsewhere (Alba-



Fig. 1. - *Location of the main sites discussed in the text.*

rella & Davis 1996; Davis in press), and it will only be briefly discussed here.

Modern breeds have larger bones than most animals found in archaeological sites. It is also known that specimens found in 19th, 18th and to some extent 17th century levels tend to be larger than medieval animals, though in most cases not as large as recent “improved” breeds. We have known this from

archaeological and historical evidence for a long time, but recent archaeological work has thrown further light on the problem. The main findings of this more recent research can be summarised as follows: a. in medieval times different sizes of cattle and sheep could be found in different regions of England. It seems that animals from peripheral areas, such as the west country and the far North, were smaller

(Albarella & Davis 1994). The small size of Welsh and Cornish livestock is also mentioned in historical sources (Thirsk 1967)

b. the increase in size started, at least in some areas and for some species, earlier than was thought in the past. At Launceston Castle we have evidence of a substantial size increase already in the 16th century, and, although much smaller, in the 15th century (Fig. 2). Very large 16th century animals have also been found at Lincoln (Dobney *et al.* 1996) and Camber Castle, Sussex (Connell & Davis in prep.). The presence of “improved” sheep in 16th century Cornwall is also mentioned by Carew (1602)

c. the size increase did not occur at the same pace and at the same time for all species. In cattle it was rather sudden, whereas in sheep much more gradual (Fig. 2). In pig and domestic fowl it occurred at a later stage, perhaps no earlier than the 17th century.

How and why did this increase occur? The first question is far from easy to answer, but it is probably safe enough to say that it resulted from a combination of local improvement and introduction of different, larger breeds from the continent. The relative importance of these two components probably varied in different regions, but undoubtedly both played a role. The importation of large, “long legged” Dutch cattle

in the 16th century is attested by historical sources (Trow-Smith 1957, 203), but surely other kinds of overseas livestock contributed to the improvement of local breeds, perhaps in a way similar to what had happened during the Roman conquest. An improved level of nutrition can also cause an increase in body size, not necessarily connected to a genetic change. However, our evidence from Launceston Castle and Castle Mall indicates that not only bones but also teeth became larger. Teeth are much more conservative in their structure and less susceptible than bones to environmental changes (Degerbøl 1963; Payne & Bull 1988). It is therefore likely that an increase in tooth size is related to the presence of a genetically different type of livestock.

An answer to the question “why” can be provided only once the other innovations have been discussed. It is quite obvious that larger animals provide more meat, but more important than the absolute body size of the adult animal is the speed of the development after birth. The archaeological evidence suggests that this could be obtained through the creation of faster growing animals, in many respects similar to the modern breeds. But to understand this phenomenon more fully we have to turn our attention to the changes which occurred in the kill-off patterns of the main livestock.

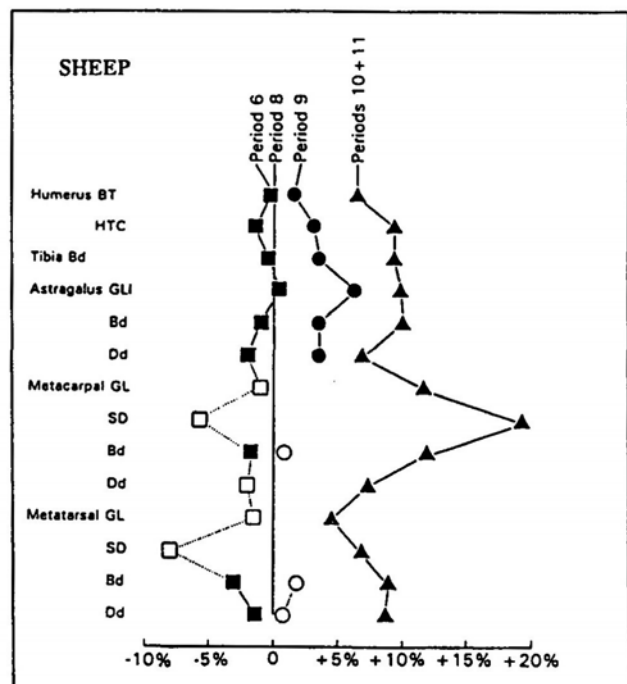
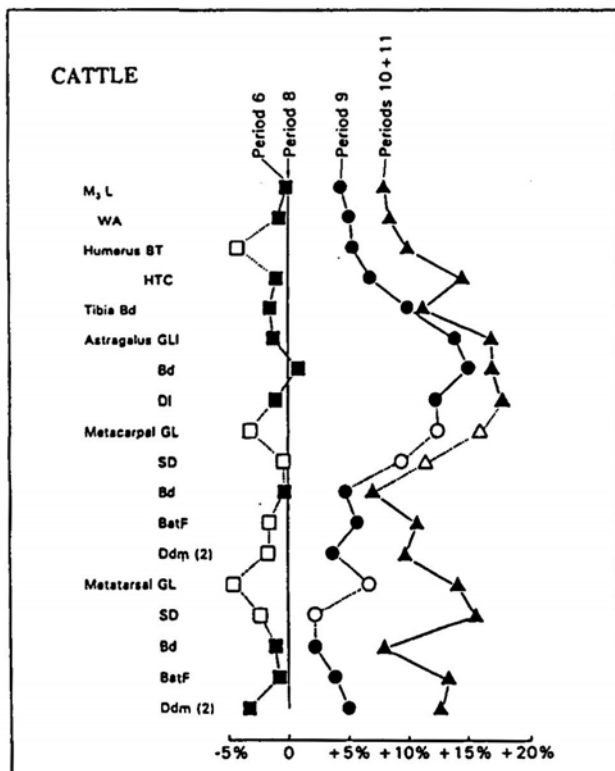


Fig. 2. - Size increase in cattle and sheep at Launceston Castle (from Albarella & Davies 1996). Percentage differences from period 8 for selected measurements. Samples where $n < 10$ are shown as open symbols. For a definition of the measurements see von den Driesch (1976) and Davies (1992). Period 6 = late 13th c., Period 8 = 15th c., Period 9 = 16th - early 17th c., Period 10 + 11 = late 17th - early 19th c.

Veal

Most cattle bones found in early medieval contexts from English sites belong to fully mature animals. However, in 15th-16th century and later contexts large numbers of bones and mandibles of calves are found alongside adult specimens (Grant 1988). This evidence is particularly striking at Norwich, where in contexts pre-dating the 15th century there are only mature animals, but there are plenty of juvenile specimens in later phases (Jones 1994; Moreno Garcia forthcoming; Albarella *et al.* forthcoming) (Fig. 3). At the Norwich site of St. Martin-at-Palace Plain, calf bones are found in contexts dated as early as the 14th-15th century (Cartledge 1987), which suggests that this change in the kill-off pattern might have occurred even earlier in Norwich than in other parts of the country. Further evidence for a change in the cattle mortality curve comes from other sites across England such as Exeter (Maltby 1979), Sandal Castle (Griffith *et al.* 1983), Leicester St. Peter's Lane (Gidney 1991b and 1991c), St. Andrew's Priory (O'Connor 1993), Launceston Castle and Lincoln (Dobney *et al.* 1996).

This new culling strategy for cattle may be associated with a major change in their use. During most of the Middle Ages cattle had mainly been exploited for their traction power, but with the increasing use of horses for ploughing and other agricultural activities, there was a change in the use of cattle, which, by post-medieval times, had, in many areas, mainly become a source of meat and milk (Trow-Smith 1957; Langdon 1986; Dyer 1991). The fattening and culling of young calves would have gone hand in hand with the production of high quality veal – very much sought after by townspeople (Thirsk 1967) – and the exploitation of cow milk for human consumption. Beef production also increased in importance and in some sites we have indeed a lower percentage of elderly animals in the later phases, but in none of these sites the difference is striking.

The relative importance of meat and dairy products varied in different areas: for instance in early modern Norfolk the emphasis was on meat production, whereas in Suffolk the opposite was the case (Overton & Campbell 1992). In some “marginal” areas such as Devon and Cornwall apparently the move away from the use of cattle for traction never occurred (Trow-Smith 1957). If this is indeed true, then the young calves found in 16th century contexts from the Cornish site of Launceston Castle might have been imported from further afield.

Horse power

It is suggested above that the changed kill-off pattern in cattle may be associated to the increasing importance of horses in agriculture. This phenomenon is well known from historical sources and it has been fully discussed by Langdon (1986). Langdon suggests that horses started replacing cattle as the main traction animals as early as the 12th century, but this was a very gradual phenomenon, and it is only in early modern times that the importance of horses reached its peak (see also Overton & Campbell 1992).

The archaeological evidence for these innovations in the use of equids comes from two main lines of evidence: the higher frequency of horses in bone assemblages from late medieval times and their increased size. Many factors contribute to the frequency of species found in faunal assemblages and its interpretation is therefore hardly straightforward. One further complication is that horses are not primarily meat animals and therefore their patterns of disposal tend to be different from those of cattle. For the same reason they are expected to be more frequent on sites where there was low meat consumption and rarer on sites where much meat was eaten. It is interesting in this respect to compare the frequency of horse bones at West Cotton, Launceston Castle and Norwich, Castle Mall (Fig. 4). In all sites there is a steady increase in horse frequency with time, but probably only at West Cotton – a rural site – can this be attributed to an actual change in the relative importance of different animals: our assumption was that in the late medieval period horses had started replacing cattle as the main traction animals (Albarella & Davis 1994). At Launceston Castle the higher number of horses in post-medieval times might merely be attributed to the fact that the site changed its status, and by the 16th century it was hardly used by the aristocracy. A lower status probably implies a lower consumption of meat and a higher frequency of non-meat animals – alongside horses dogs also become more common in the 16th century and later. At Castle Mall the very marked occurrence of horses in the latest phase is probably merely attributable to a change in disposal practices. Complications therefore exist and caution is necessary in interpreting the relative frequency of different species. Nevertheless, a general trend towards increase in horse frequency seems to be an actual feature of some late medieval sites.

The use of horses for ploughing probably encouraged the selection of larger and stronger animals. By the 14th century in France and England a large horse, defined as “*magnus equus*”, seems to be present, which suggests that some increase in size was taking

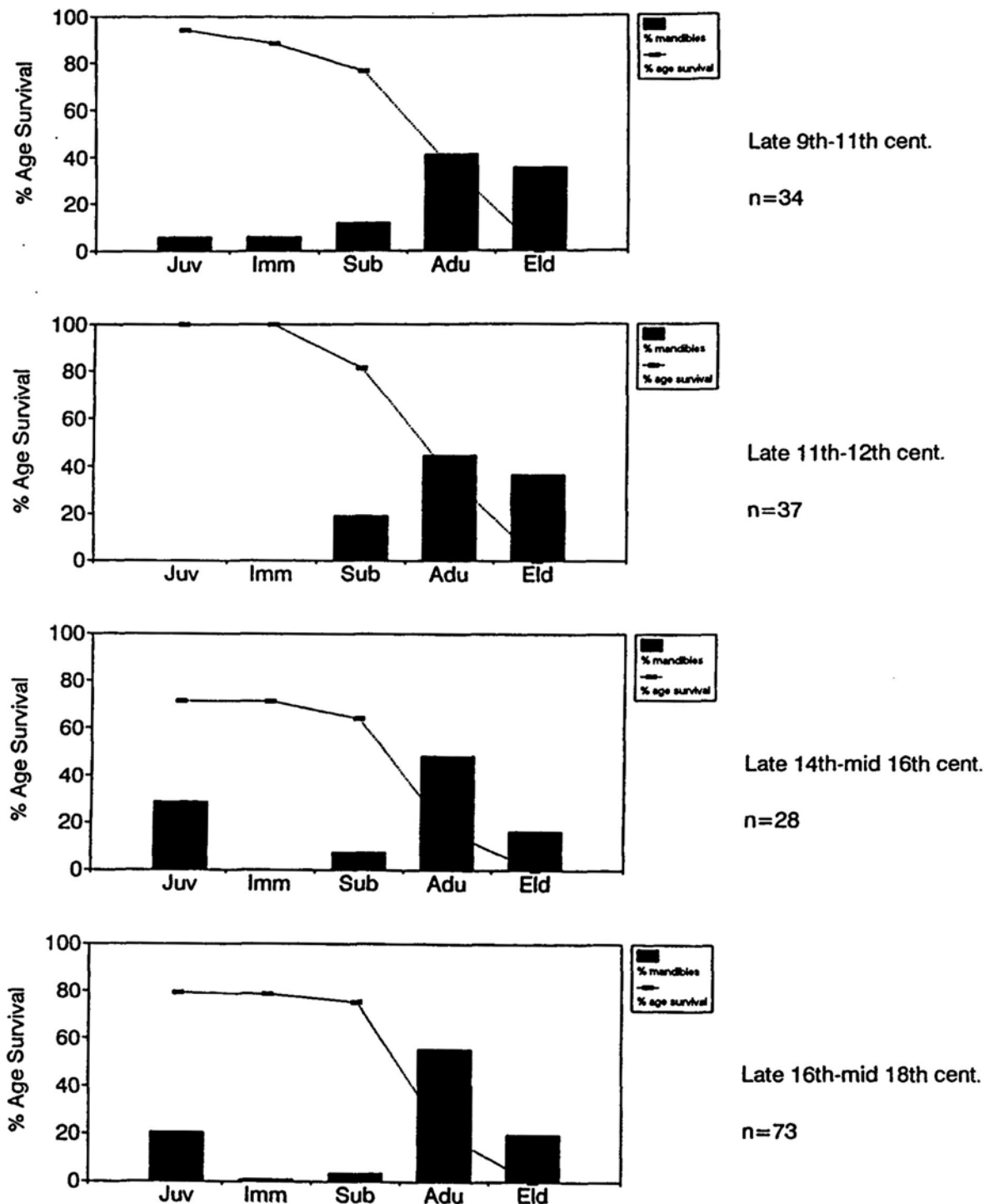


Fig. 3. - Relative percentages of Cattle mandibles by age stage in different periods at Norwich, Castle Mall (from Albarella, Beech & Mulville forthcoming). Age stages are from O'Connor (1988). Juv = juvenile, Imm = immature, Sub = subadult, Adu = adult, Eld = elderly.

place (Langdon 1986). However, the archaeological evidence indicates that late medieval and 16th century horses were probably barely larger than a pony (the maximum height for a pony is 14 hands and 2 inches), yet somewhat larger than their Anglo-Saxon and early medieval predecessors (see Dobney *et al.* 1996 and Albarella *et al.* forthcoming). This suggests that horse breeders had made some progress towards the production of larger breeds.

Wool

It is hard to find a product more important than wool in the English medieval economy (Farmer 1991). By the beginning of the 13th century English wool was considered the best in Europe (Grand & Delatouche 1950) and it was exported in large quantities, either as raw material or as cloth. The wool trade probably reached its peak in the late 13th –

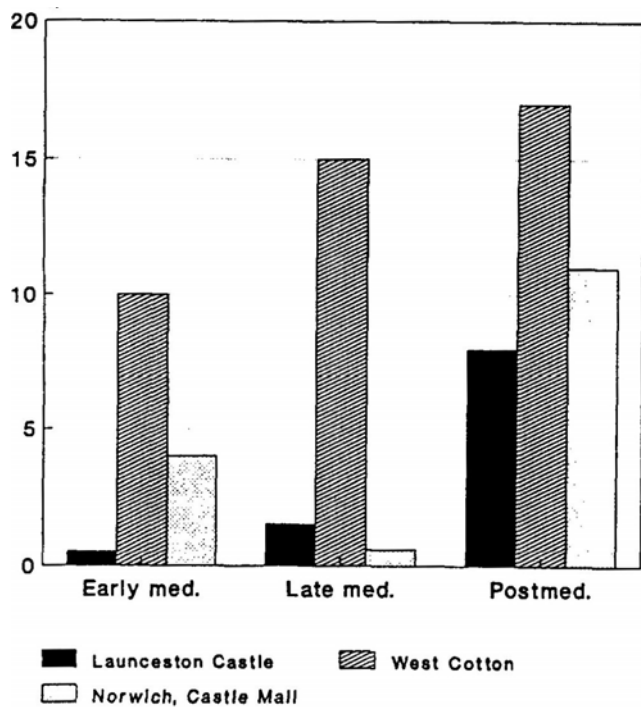


Fig. 4. - Frequency of horse bones at Launceston, West Cotton and Castle Mall.

early 14th century (Dyer 1988 and pers. comm.), and did not decrease in importance in later times, despite the pressure to produce more mutton (Trow-Smith 1957). In this respect the destiny of sheep exploitation was different from that of cattle, for which one main function – meat production – ended up replacing the previous one – traction power.

The ever increasing importance of sheep is not only attested by historical sources, but by also substantial archaeological evidence. In many archaeological sites the frequencies of sheep remains increase in later medieval and post-medieval times, mainly at the expense of pig (Grant 1988; Overton & Campbell 1992; Albarella & Davis 1994; Albarella *et al.* forthcoming). This increase probably reflects the rise of the wool trade. This assumption is reinforced by the study of kill-off patterns. A trend towards culling of older animals in late medieval and post-medieval periods has been found on many sites in different areas of England, such as Leicester St. Peter's Lane (Gidney 1991b and 1991c), Leicester, Little Lane (Gidney 1991a and 1992), Colchester (Luff 1993), West Cotton (Fig. 5), Launceston Castle, Lincoln (Dobney *et al.* 1996) and Norwich, Castle Mall. Although a few exceptions can be found – for instance at Exeter a large number of lambs were recovered in the post-medieval levels (Maltby 1979) – these findings suggest that wool production continued to be important in the 16th and 17th centuries.

Without doubt wool was important in Saxon and early Medieval times too, but then the main emphasis was on meat and possibly milk production. It is likely that the same flock was used for more than one purpose, with animals killed sufficiently young to provide good quality mutton. In later times sheep were only slaughtered after two or more fleeces had been taken. But even then mutton still had some importance. This is suggested by the fact that quite often the mortality peak is at about four years. Indeed Muffet (1655) advises that good mutton does not have to be older than four years. If the late medieval economy had been highly specialized in wool production we would expect an even older age for these animals. In fact a highly specialized husbandry is a contemporary phenomenon. In the past farmers tended to use animals for many purposes, though there could be an emphasis on one or two products.

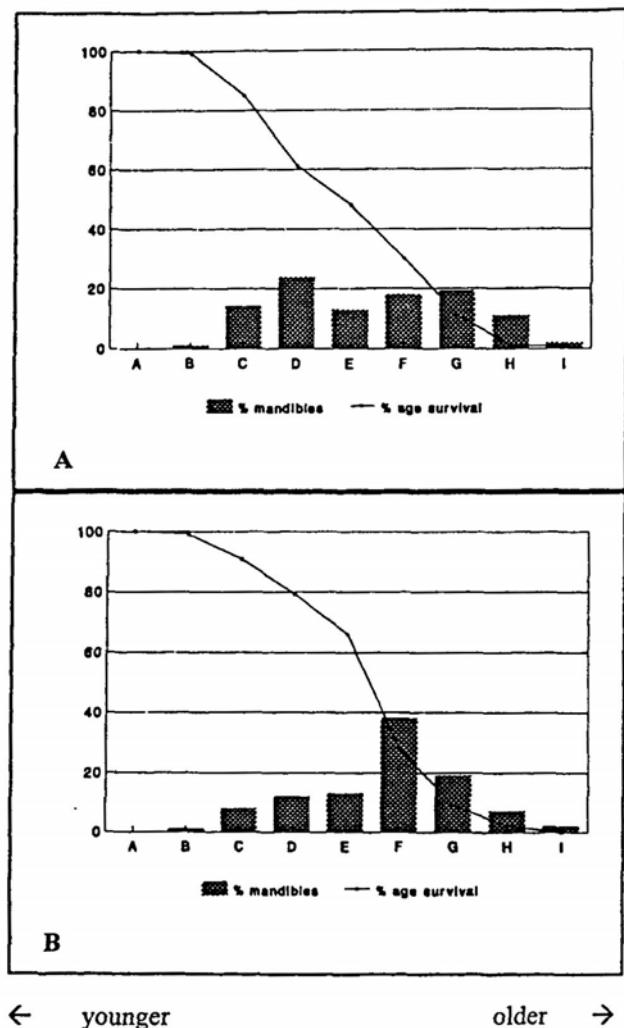
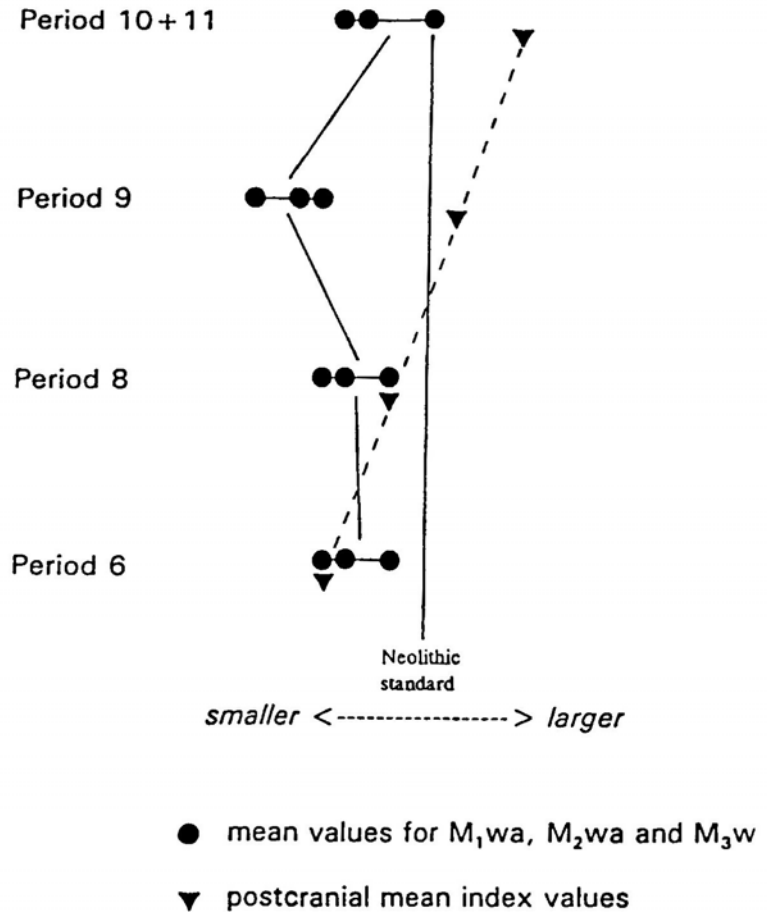


Fig. 5. - Relative percentages of Sheep mandibles by age stage in different periods at West Cotton (from Albarella & Davies 1994). Age stages are from Pyne (1973).
A. West Cotton, Early Medieval, n=99.
B. West Cotton, Mid-Late Medieval, n=99.

Fig. 6. - Size changes in Pig teeth and postcranial bones from Launceston Castle (from Albarella & Davies 1996) using a log ratio for comparison with a standard Neolithic pig sample from Durrington Walls, Wiltshire, England (Albarella & Payne in prep.). M_{1wa} , M_{2wa} and M_{3w} are the anterior widths of the first², second³ and third lower molars, as defined by Payne & Bull (1988). See Fig. 2 for the chronology of the periods.



The size increase in sheep which starts being archaeologically recordable at least since the 16th century (see above) represents evidence of a concern in the “creation” of animals with a larger body mass and which would therefore produce more meat. Wool and meat production were going in parallel directions and the aim of the late medieval/early modern agriculturalists was probably to “create” animals which could efficiently provide both products.

Fast growing pigs

Unlike cattle and sheep no major changes in the size or age at death of pigs seem to have occurred within the Middle Ages. However, the evidence is still rather sparse. The study of size variation in pig has been handicapped by the fact that most postcranial bones of pigs from archaeological sites are juvenile (i.e. the epiphyses are unfused) and therefore not useful for determining size. Moreover, measurements of pig teeth have only occasionally been taken by zooarchaeologists, at least until Payne and Bull's (1988) publication which emphasized the importance of dental measurements.

We cannot therefore exclude the possibility that changes in pig size might be detected in future. In the

meantime, we have evidence that pig breeds and pig husbandry had been subject to some change at least by the 17th century. Data from Launceston Castle, Castle Mall and Lincoln (Dobney *et al.* 1996) all indicate that in post-medieval times new types (breeds?) of pigs were present in England. Compared to the medieval animals these had much larger bones and only slightly larger teeth. Interestingly, the 16th century animals from Launceston Castle had slightly larger bones, but smaller teeth than their medieval ancestors (Fig. 6), possible evidence for the presence of yet another type of pig, different from both the medieval and the 17th century animals.

Pigs are generally killed at a younger age than most cattle and sheep, as they are exploited almost entirely for meat and fat. However, we have archaeological evidence from Exeter (Maltby 1979), Lincoln (Dobney *et al.* 1996) and Castle Mall that pigs were being culled at an even earlier age in post-medieval times, with most animals slaughtered when approximately one year old. In fact, this is the age when the culling of pigs was recommended by early modern agriculturalists (Markham 1614; Mortimer 1707). At Launceston Castle such a change in the kill-off pattern did not occur, and this is consistent with what we know from historical sources about a rather late culling strategy in the west country (see Marshall 1796).

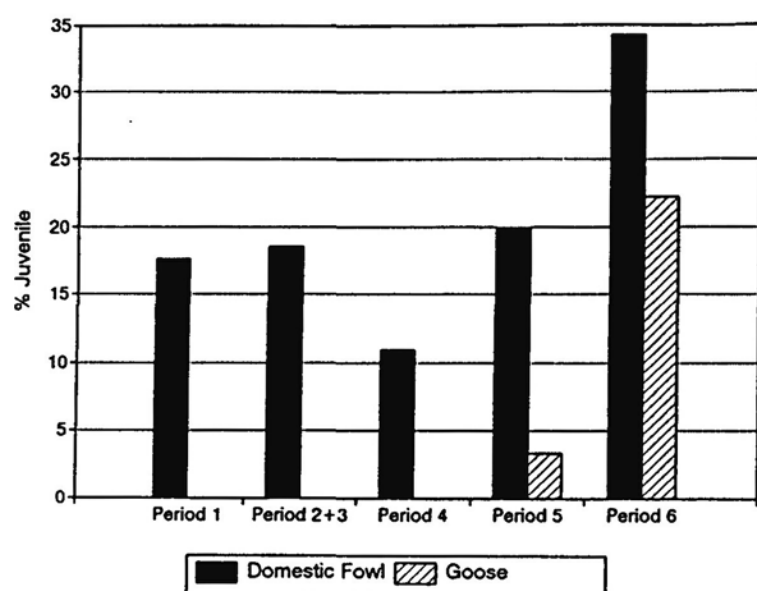


Fig. 7. - Relative percentage of juvenile domestic fowl and goose at Norwich, Castle Mall (from Albarella et al. *Fothoncoming*).

Period 1 = late 9th-11th; Period 2 + 3 = late 11th-12th; Period 4 = late 12th-mid 14th; Period 5 = late 14th-mid 16th; Period 6 = late 16th-mid 18th.

		Period 1	Period 2 + 3	Period 4	Period 5	Period 6
Sample sizes (Total NISP)	Domestic Fowl	245	151	146	176	111
	Goose	25	32	29	60	27

The changes in size and mortality are obviously connected. The culling of younger beasts became possible only because of their size increase. Indeed it is inconvenient to kill animals when they are too young, because this is an inefficient use of their body mass. But if the animals are fast growing and thus reach their full weight early, the age of their slaughtering can be brought forward. This was probably the main improvement in pig husbandry in post-medieval times.

The fact that post-medieval pigs, had bones relatively larger than teeth can also be, at least in part, attributed to a higher level of nutrition. But the fact that teeth, although to a much lesser extent, also increased in size, suggests the existence of a genuine genetic difference between medieval and post-medieval animals. The importation of new breeds in the 18th century (Epstein & Bichard 1984) surely at least in part contributed to the creation of the modern types.

The decline of the goat

In medieval times goats were probably bred mainly for milk. The production of kid meat – which was considered a great delicacy (Wilson 1973) – was probably a by-product of dairying. The meat of the adult goat was never highly regarded in England (Markham 1614; Burke 1834) and it was thus probably consumed by goat breeders themselves and only occasionally sold in the market. Moreover, goats are

animals of warm climates and rocky environments and have never been very successful in northern Europe. Because of their “browsing” habits they are also destructive animals and consequently they had to be kept clear of woods (Fussell 1936; Dyer 1991 and pers. comm.) and possibly confined in mountainous areas (Thirsk 1967). Burke (1834) suggests that the situation got worse when land was enclosed – one of the main innovations of the “agricultural revolution” (Kerridge 1967) – because goats tended to destroy hedgerows; as a consequence they were “banished ...from the soil” (Burke 1834). However, the situation probably varied in different areas. In localities in the West Midlands for instance goat breeding was discouraged in the 13th century, but “when the pressure on resources relaxed” in the following two centuries – mainly due to the human demographic decline – quite large numbers are recorded (Dyer 1991).

In most English sites, including Exeter (Maltby 1979), North Elmham (Noddle 1980), Colchester (Luff 1993), Launceston Castle and Castle Mall, by post-medieval times there is a sharp decline in the number of goat bones. Due to the wide distribution of these sites this is likely to be a countrywide phenomenon. It is possible that, as Burke (1834) suggested, the enclosure of land played an important role in the decline of goat in England. Another possible explanation is that the function of the goat as a milk producer had lost its importance, due to the greater emphasis being put on cattle dairying.

Domestic birds

The main domestic mammals provided most of the meat and other animal products, but the importance of birds in the medieval economy should not be ignored. Domestic fowl and goose in particular were important sources of meat, eggs and, in the case of the goose, feathers too (Grand & Delatouche 1950). It is difficult to assess whether the importance of domestic birds relative to mammals was subject to any kind of change in late medieval and post-medieval times. Bird bones are generally much smaller than mammal ones, and are therefore subject to different patterns of recovery and preservation. Differences in the frequencies of mammals and birds often merely reflect recovery and preservation biases rather than genuine economic differences. Another problem is the dearth of bird bone assemblages from post-medieval sites. Large quantities of bird bones are generally collected only from sieved samples, and due to a lack of interest that is sometimes paid to relatively recent periods, sieving on post-medieval sites is only rarely undertaken.

Notwithstanding problems of recovery, some interesting information about changes in the use of birds could be detected from our study of the Castle Mall animal bones. In the case of domestic fowl, in the 15th-16th century and later we found a higher number of males and juveniles than in early medieval times (Albarella *et al.* forthcoming, but see also data in Moreno Garcia forthcoming) (Fig. 7). A larger size of the chicken bones in the later levels was also noted. This might reflect a change in the use of this species. Whereas in medieval times there was a mixed economy aimed at the production of both meat and eggs, in later times a breeding system more specialized towards meat was probably taking over. The production of good quality meat would imply the killing of young animals and an emphasis in the creation of larger breeds. Moreover there would be no need to keep a high number of adult females – an ideal ratio of about five hens to one cock is recommended for egg production (Columella VII.2.13 and

Grand & Delatouche 1950) – hence the higher frequency of adult males at post-medieval Castle Mall. A higher number of young specimens in late medieval levels has also been noted on other English sites (Grant 1988).

Goose breeding was moving approximately in the same direction. No juvenile goose bones were found in any medieval periods at Castle Mall, but several were found in levels from the 15th century onwards (Fig. 7), suggesting that, like the chicken, in post-medieval times geese were being kept primarily for their flesh. A similar increase of juvenile geese in later periods has also been noticed at Winchester (Rees & Serjeantson forthcoming).

A new economic system

We have seen that important changes occurred in the type and use of domestic animals between the 15th and the 17th century in England. The time span of these innovations is so wide that we can hardly regard them as a “revolution”. However gradual these phenomena could have been, it is clear that by the beginning of the modern era a new economic system of animal husbandry was under way. The main changes have been discussed above and are summarised in the following table (the animal products or uses of greater importance have been indicated in capital letters) (see table below):

Hides, skins, wool fells, bones and horns were also intensively used, but probably they could never be regarded as anything more than important by-products. These changes only represent broad trends and they are not necessarily true for all parts of the country. Local exceptions certainly occurred. The trend regarding domestic birds in particular is here presented in a rather tentative way: many more data from post-medieval sites are needed.

The changes were not all simultaneous. We have seen for instance that the replacement of oxen by horses for ploughing may have occurred in some

	medieval	late medieval - post-medieval
Cattle	TRACTION, meat, milk	MEAT, milk (traction in limited areas)
Sheep	WOOL, meat, milk	WOOL, MEAT, milk
Pig	MEAT, fat	MEAT, fat
Goat	milk, meat	-
Horse	traction	TRACTION
Domestic fowl	EGGS, meat	MEAT, eggs
Goose	FEATHERS, eggs, meat	MEAT, feathers, eggs

areas more quickly than in others. In general it seems that variation in kill-off patterns preceded size and morphological changes: young calf bones can already be found in 15th century contexts, whereas the main size increase probably did not occur until the following century. It is plausible to assume that a new type of cattle use, more specifically aimed at the production of meat, was associated with a different kill-off pattern and led to the selection of larger beasts. In the case of the sheep the variations in age and size may not be associated. The selection of older animals was mainly aimed at the production of more wool, whereas the somewhat later phenomenon of size increase was mainly caused by the concern to produce more meat.

Economic systems are complex and they comprise a series of interacting variables. Therefore it is not surprising that one change in the system caused the need to adjust the other elements in order to find a new equilibrium. A change in the use of one animal species necessarily led to a modification in the husbandry of the rest of the livestock. For instance when cattle started being slaughtered at a younger age to provide more meat, the traction power that this animal used to provide had to be replaced in some way. Hence the increasing importance of horses in the later Middle Ages.

However, economic systems are never isolated, and if changes occurred, we must wonder what was the external force behind them. To try to solve this problem it is necessary to bear in mind that, as well as the economy, late medieval human society was in a state of instability and many changes were taking place (Dyer 1989a). The pestilence of the 14th century caused a dramatic drop of the English population (Hatcher 1977) and as a consequence the following century was characterized by such a reduced pressure on resources and on the countryside (Dyer 1989b), that Postan (1972) writes of a “decolonization” of the land. The 16th century saw a new demographic increase (Wrigley & Schofield 1981) and as a consequence a renewed intensification in the use of natural resources. The later Middle Ages had also seen a shift from a more agrarian to a more pastoral oriented economy (Harvey 1991), to the extent that livestock density in eastern England almost doubled (Campbell & Overton 1992).

Looking back at the above table it is possible to see that a general consequence of the late medieval changes was a greater emphasis on meat production. All animals which could provide a reasonable amount of meat were by post-medieval times mainly reared for this purpose, with the only exception of the sheep for which wool was an equally important product. If we also take into account the higher dens-

ity of livestock in this period, the sheer quantity of meat that was possible to produce in the 15th-16th century must have been far greater than in early medieval times. The demand for more meat by the growing population was also associated with changes in consumption patterns generated by a “degree of material improvement for many sections of urban society” (Dyer 1989a, 210). It is likely that the individual rate of meat consumption increased after the Middle Ages, although this was not a continuous trend and fluctuations occurred – for instance as a consequence of the fall in value of wages in the second half of the 16th century (Chris Dyer pers. comm.). However, the demand for meat supply – in particular from the towns – must have been – by post-medieval times – quite remarkable.

A more intensive pastoral production was already on its way in the 15th century, and it might have been one of the key factors which encouraged the subsequent demographic growth. At some point the two phenomena – population growth and higher farming productivity – probably started reinforcing each other. More recently the beginning of the mechanization in agriculture and the development of intensive stock rearing gave a further boost to the demographic increase, though unfortunately this has been at the expense of animal welfare.

In conclusions, our archaeological evidence supports and complements the findings of historians such as Kerridge (1967), Langdon (1986) and Dyer (1989a) that a new system of animal exploitation was on its way by the end of medieval times. A system which permitted a more efficient use of resources, a higher output of meat and ultimately supported the growth of the English population.

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